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Workstation Design in an Ethiopian Small Scale Leather Garment Industry

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Abstract

There are many survey based researches in the recent literature to investigate the critical factors that affect the development of Small and Medium Enterprises (SMEs). No study, however, dealt about workstation design which integrates the most important resources of SMEs, i.e., labor and machineries. The aim of this research is to fill this gap by a different and practical approach. One of the labor intensive industries, leather garment sector was selected for the study. Moreover, Genuine Leather Crafts (GLC), a small scale industry, is taken as the case. The analyses revealed that GLC's labor and machine productivity have been very low associated with poor workstations design. A new method is proposed to improve the resource utilization of GLC in particular and SMEs in general. Business development agencies should also give especial attention to the internal factors where the strength of SMEs made up of.

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Key words: SMEs; Work station design; Leather garment

1. Introduction

Ethiopia has the largest number of livestock in Africa and the tenth largest in the world. Leather industries have been manufacturing mainly wet blue leather for many years. Very recently, the government has changed its policy from wet blue to finished leather and leather products manufacturing, more value addition. This enables the development of SMEs in the leather product manufacturing sector,

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mainly, footwear and leather garment industries. The former is growing at a fastest rate while the latter is still challenged by high cost of products and longer production time which failed them to compete in the market.

Small scale industrial development has been given due attention by the developed and as well as the developing countries. Researches were also conducted to make small scale industries competitive in the global market. The researches were focused either in the external or internal factors for the success of SMEs. The external factors are: social capital (Kunataric, 2012), networks (Barclay, 2005), uncertainty (Koh, 2005), supply chain (Eyaa, 2010), etc. The internal factors are: technology (Gunzel, 2012), marketing (Gilmore, 2001; Poolton, 2008, Gilmore, 2011), directors and boards (Coulson-Thomas, 2007), human resources management (Richbell, 2010; Torres, 2011), innovation and R&D (Pett, 2011), training (Johnston, 2003; Manimala, 2008), product and process improvement (Pett, 2009), strategies (Racic, 2008), public relations (Moss, 2003), etc.

No research has been conducted on the significance of workstation design to improve labor and machine productivity where the central competitive advantages of SME's lay on. Furthermore, the limitation to the recent researches in the SMEs development is the research approach adopted by researchers. Since almost all of the studies are survey based, the researches ability to reveal problems at the shop floors are limited. This study, therefore, fills the gap and paves a new direction to the researches in the area of SMEs development.

2. Methods

Most of the researches in the SMEs development are survey based which will have limited contribution to understand the internal problems at the shop floor. This research adopted a case study which is not common in SMEs research. Among the SMEs leather garment sector was the focus because of three reasons: availability of abundant resource, the government priority and the possibility of replicating the results to the textiles garment industries which have similar features with the leather sector. The case company, GLC, is selected for the study since it produces for export market and availability of well documented data. Inputs, production time, costs of production, machine and labor productivity are in-depth analyzed to define the problems. The data are both from primary and secondary sources. Machine productivity is measured by direct video recording when the employees are on duty. The remaining is obtained from the company records.

3. Genuine Leather Craft

Genuine Leather Craft (GLC) is established in 1992 in Addis Ababa. Its business plan is to export and to meet local market by various leather products using high quality raw materials such as Bati Geniune, Selallie Genuine, etc. The company's main products are men's and women's jackets, coats, trousers, lady's skirts, vest, belts, upholstery, and other large and small leather goods. This research zooms in leather jacket because leather jacket production volume is the highest and the production processes describes all other processes in the organization. Hence, the result obtained in improved leather jacket manufacturing would be easily adapted to other products in the factory.

3.1. Inputs and Costs of Production

Leather jacket production requires numerous inputs. Major inputs, cost per piece, quantity per jacket and cost are mentioned in Table 1 below. The major cost of a jacket, which is more than 74%, is the

leather cost followed by labor cost which accounts for about 21%. Reducing the leather cost needs to work on the backward value chain. But, the labor cost can be minimized under the company's scope.

Table 1. Major inputs of leather jacket and their costs

No	Items	Cost per Piece	Qty per Jacket	Cost per Jacket(Br)
1	Leather (Skin /Hide)	166 Br/ m^2	4.1m^2	680
2	Lining (Polyester)	2.25 Br/m	2 Meter	4.50
3	Interlining (Non woven)	3.50 Br /m	0.75 Meter	2.50
4	Thread (Leather)	26Br /250gram	-	3
5	Wad	8Br	-	4
6	Push Button	0.75 Br/unit	7	3
7	Cording	0.35 Br/m	2	0.70
8	Stopper	0.50	4	1
9	Zipper	7 Br	1	7
10	Glue	60Br /liter	-	4
11	Utility Cost	700 Br/month	-	10.60
12	Labor Cost	12926.46 Br/month	-	195.86
			Total	**916.16Br**

3.2. Production Time

To manufacture a leather jacket the main operations and their respective time is presented in Table 2. More than 80% of production time is preparation and stitching operations. This operation is where major improvement could be achieved. The main activities conducted by the operator in the stitching work station are searching, selecting, picking, preparation stitching, and inspection. Man-hour-per-jacket could be improved by either eliminating or modifying the non-value adding activities (picking, preparation, inspecting and placing).

Table 2. Major operation and time required

No	Major Tasks	Average time Required
1	Receiving Order	5min
2	Designing the pattern	60min
3	Cutting the leather	30min
4	Preparation and stitching	480min
5	Finishing	15min

3.3. Machines Productivity

To illustrate the utilization of machines, data has been repeatedly taken for hours by video taping. The stitching and the preparation time take a total of 66.14 minutes. The machine utilization in 66.14 minutes is 8.05 which is 12.2 % (See Table 3). Therefore, in the existing working method at GLC the machine utilization is very low.

Table 3. Stitching and preparation time in an operation

No	Task	Recorded time (Minutes)	Difference in a consecutive operations	Preparation Time	Stitching Time
1	Preparation	4.08	4.08	4.08	
2	Stitching	5.29	1.21		1.21
3	Preparation	6.33	1.04	1.04	
4	Stitching	8.21	1.88		1.88
5	Preparation	12.51	4.3	4.3	
6	Stitching	13.13	0.62		0.62
7	Preparation	16.24	3.11	3.11	
8	Helping colleagues	16.53	0.29	0.29	
9	Preparation	25.07	8.54	8.54	
10	Stitching	25.5	0.43		0.43
11	Preparation	32.1	6.6	6.6	
12	Stitching	35.5	3.4		3.4
13	Preparation	38.08	2.58	2.58	
14	Stitching	38.59	0.51		0.51
15	Preparation	66.14	27.55	27.55	
			Total	**58.09**	**8.05**

3.4. Labor Productivity

Stitching operators' performance is seen in Table 4 below. Operators' performance varies among workers significantly. This shows that workers are not doing at their full potential on one hand and there is no defined working method on the other hand. In a six months period the company produce 397.8 jackets by seven workers. Using this data man-hour-per-jacket is calculated. The result shows that, a jacket takes 24 working hours (three days) on average or it means a worker can produce 39% of a jacket-per-day. The figure is very low because some workers are performing very poor. But if the highest performance is taken i.e. 17.5 in the month of November where there are 26 working days the number of jacket per day is 67%.

Table 4. Number of jackets produced in six month period

No	Employee Code	No. of Jackets in 6 Months (Working days) 2001EC (2008/2009 GC)							Jacket per day	Man-Hour per Jacket
		Sept (23)	Oct (25)	Nov (26)	Dec (25)	Jan (25)	Feb (23)	Sub Total		
1	12	6.75	9	15	13	14	13.83	71.58	0.5	16
2	14	12	10	11	10.5	8	12.5	64.00	0.4	20
3	24	11	8	13	9.5	7.5	10.5	59.50	0.4	20
4	23	15.25	11.5	17.5	10.5	14.5	15	84.25	0.6	13.34
5	22	14	9.5	16	5	3	9	56.50	0.4	20
6	11	3	5	5.5	5.5	4	7.5	30.50	0.2	40

7	21	3	5	5	5	7	6.5	31.50	0.2	40
							Total	**397.8**	**2.7**	**169.34**
							Avg.	**56.83**	**0.39**	**24.194**

When summed up, the productivity of the labors and the machines in GLC are very low in any standard. Machineries are working well below 20% of their capacity. Furthermore, the time required to produces a single jacket requires 1.5 days on average for a person. This weakens the sectors' competitiveness in the local and international market. Therefore, work station design is an appropriate strategy to maximize labor and machinery utilization and as a result to reduce product cost and the time required to manufacture.

4. Workstation Design

In GLC PLC, the sub-assembly parts don't have any sequence. For instance, a worker may start from sleeve, collar, facing or other. This method of working increases the numbers of searching, selecting and orientation. Order should be established for ease of planning and documentation. Starting from the bigger to the smaller size as revealed in the diagram below which will help to be perfect and also help to keep the symmetry.

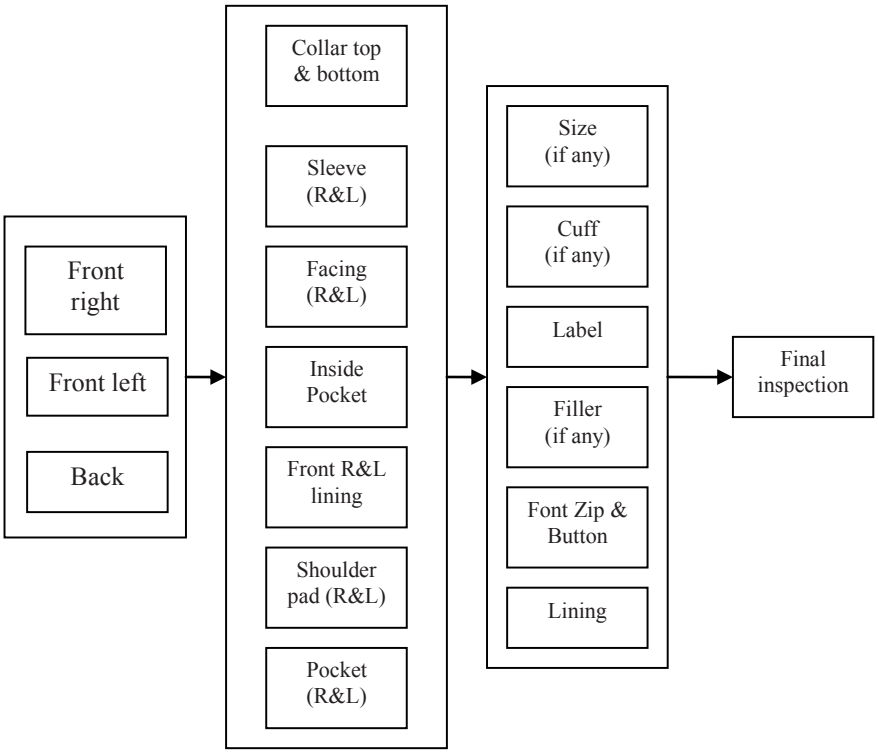

Figure 1. Improved sequence of the stitching process for a leather jacket

From the above stitching sequence there are some parts that can be semi-finished for final assembly. Label, hanger, front pocket, shoulder pad and inside pocket can be made before receiving an order

because these parts are the same no matter the size vary. These parts can be prepared at the time of low demand period when there are idle sewing operators. The times required in preparing these parts are listed below in Table 5. A total time 23.22 minutes is required. Since these parts are done when there is idle time, it will have a direct impact in reducing the due date of a Jacket.

Table 5. Time required to prepare component parts

No	Items	Qty per Jacket	Preparation Time (Min)
1	Shoulder Pad	2	1.2
2	Front Pocket	2	4.77
3	Inside Pocket	1	2.45
4	Piping	5	5.4
5	Label	1	7.6
6	Hanger	1	1.8
		Total	23.22

As explained above in a stitching operation there are two tasks – the value adding and non-value adding tasks. Stitching is the only activity which adds functional value to the product. Whereas, searching, selecting, picking, preparation, and placing are non-value adding activities. If all these non-value adding activities be eliminated or minimized, then the productivity of the labor as well as the machines would definitely increase. Often, naturally in the human mined, searching is followed by selection and selection is usually precedes grasp. Therefore, if these three non-value adding activities combined together the time required and the fatigue to the operators minimized. A new approach to combine these tasks is deciding a pre-defined allocation for every element used in the stitching operation, i.e., equipment and leather pieces. With this finding, a bin is designed to put all the necessary work-in-processes and tools to produce a leather jacket. Furthermore, it is designed based on the operators' body dimensions. See Figure 2.

As illustrated in the sequence of operation above, sewing operators may search, select, grasp, and rearrange the orientation for more than 44 items. Workers also search equipment like scissors, glue etc. Using video taping the time that could be saved based on the improvement is summed up to 140 minutes in a leather jacket stitching operation.

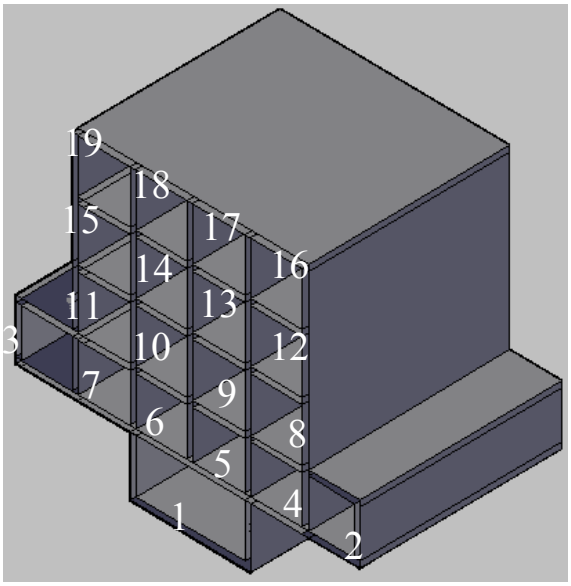

Figure 2. 3D diagram of the bin

Every pieces and tools will have their unique number and the bins also have number to put all in place. Then, the bin will be mounted in the left side of a sewing machine. As seen on Figure 3, the operators access all the necessary pieces and tools at hand length. It enables the operators to increase their performance, the machine productivity and it also decrease fatigue.

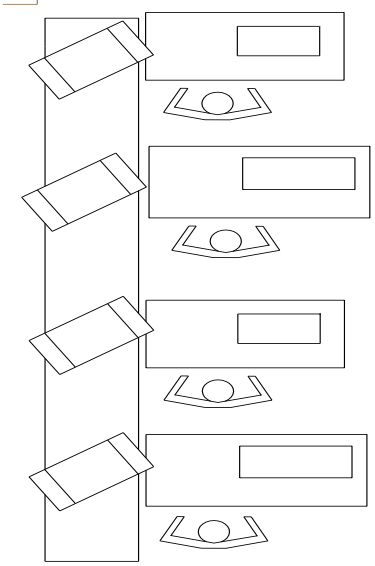

Figure 3. A new workstation design

Applying the new workstation design improved the productivity significantly. As discussed above the average time required to produce a leather Jacket is 1.5 days which means 720 minutes. In the new method pieces pre-prepared took about 24 minutes and the time saved by the reducing the non-value adding activity is about 140 minutes. When total, the saving in time in the improved method is about 164 minutes. Therefore the improvement in the labor productivity is the ratio between 164 and 720 multiplied by 100. This results in 23% labor productivity improvement. At the same time the machine availability is increased by 164 minutes in a Jacket production.

5. Conclusion and Recommendation

This research is an attempt to increase productivity of SMEs by taking Genuine Leather Craft as a case which is a leather garment in Ethiopia. For a Jacket production, the most important product of GLC, labor cost is the highest expenses next to leather cost. The labor productivity directly influences the machine productivity. After through analysis of the working condition and design an improved method is proposed. The new method aimed at reducing non-value adding activities associated with the stitching operation including; searching, selecting, grasping and placing. All in all, the labor productivity is improved by 23 %. Above all the time required to produce a jacket significantly reduced and the fatigue to the workers also reduced. Therefore, form this mini-project what clearly seen is for SMEs focusing on the means and mechanisms of improving internal competitive advantages should be given due attention by investors, researchers and business development agencies. In fact, since more than 70% of the production cost of a leather jacket is the leather cost, the research strongly recommends additional effort on the supply and/or value chain of the leather processing.

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